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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 16020-WO-03 FOR FURTHER				
International application No.	International filing date (day/	month/year) Priority date (day/month/year) 10.07.2003		
PCT/L2004/000615 08.07.2004		10.07.2003		
International Patent Classification (IPC) C08L23/00, C08J3/24, C08F255				
Applicant CARMEL OLEFINS LTD. et al.	·			
 This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 				
2. This REPORT consists of a total of 5 sheets, including this cover sheet.				
3. This report is also accompanied by ANNEXES, comprising:				
a. Sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:				
sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).				
⊠ sheets which sup beyond the discl Supplemental Bo	osure in the international applica	th this Authority considers contain an amendment that goe ation as filed, as indicated in item 4 of Box No. I and the	s	
b. [] (sent to the Internation	onal Bureau only) a total of (indi	icate type and number of electronic carrier(s)) , containin nputer readable form only, as indicated in the Supplement of the Administrative Instructions).	g a tal	
4. This report contains indicati	ions relating to the following item	ms:		
│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │	he opinion			
☐ Box No. II Priority	·			
☐ Box No. III Non-esta	blishment of opinion with regard	d to novelty, inventive step and industrial applicability		
☐ Box No. IV Lack of u	nity of invention			
☐ Box No. V Reasone applicable	d statement under Article 35(2) lility; citations and explanations s	with regard to novelty, inventive step or industrial supporting such statement		
	locuments cited			
	defects in the international application			
☐ Box No. VIII Certain o	observations on the internationa	al application		
		Date of completion of this report		
Date of submission of the demand		Date of completion of the report		
08.05.2005		31.10.2005		
Name and mailing address of the international preliminary examining authority:		Authorized Officer	J. chi	
European Patent Off D-80298 Munich		Iraegui Retolaza, E		
Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4	Tx: 523656 epmu d 1465	Telephone No. +49 89 2399-8490	TO . SAND	
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No. PCT/IL2004/000615

	Box No. I	Basis of the report			
1.	With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.				
	wnich	is the language of a t	slations from the original language into the following language , ranslation furnished for the purposes of:		
	∟ pub	olication of the interna	der Rules 12.3 and 23.1(b)) ational application (under Rule 12.4) examination (under Rules 55.2 and/or 55.3)		
2.	With regard to the elements* of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):				
	Description	ı, Pages			
	1-24		as originally filed		
	Clalms, Nu	mbers			
	8-21, 22(pa	rt)	as originally filed		
	1-7, 22(part), 23-33	received on 08.05.2005 with letter of 08.05.2005		
	□ a sequ	uence listing and/or a	ny related table(s) - see Supplemental Box Relating to Sequence Listing		
3.	☐ the ☐ the	e description, pages e claims, Nos.	ulted in the cancellation of:		
	□ the	e drawings, sheets/fig e sequence listing <i>(sp</i> y table(s) related to s	s ecify): equence listing <i>(specify)</i> :		
4.	This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).				
	⊠ the □ the □ the	e description, pages e claims, Nos. 4 e drawings, sheets/fig e sequence listing (sp	s <i>ecify)</i> : equence listing <i>(specify)</i> :		
			ome or all of these sheets may be marked "superseded."		

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No. PCT/IL2004/000615

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Yes: Claims

No: Claims

Inventive step (IS)

Yes: Claims

1-33

1-33

1-33

No: Claims

Industrial applicability (IA)

Yes: Claims

No: Claims

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

PCT/IL2004/000615

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

D1: DE 44 02 943 A (RUSTIGE BERNHARD GMBH & CO KG) 3 August 1995 (1995-08-03)

Document D1 discloses a two phase thermoplastic material consisting of a microdispersion of silane-crosslinked polyethylene (PE) in a continuous, fluid polypropylene (PP) matrix. The silane-grafted PE is dinamically crosslinked by adding a crosslinker during the mixing process, which is carried out in a mixer suitable for the dispersion of the crosslinking structure. A number of crosslinking agents is disclosed as being suitable to carry out the invention according to D1, DBTL (dibutylzinndilaurate having been exemplified (see the passages cited in the International search report together with page 3, lines 27 to 32 of D1).

The subject-matter of claim 1 differs from the disclosure of D1 in that the crosslinking agent is specified to be an acid (Article 33(2) PCT).

The problem to be solved by the present International application is to provide a process for making thermoplastic vulcanizates, wherein full vulcanization of the elastomers used in carried out (see page 4, lines 10 to 12).

The solution proposed involves the use of an acid as crosslinker, which results in thermoplastic vulcanizates exhibiting gel contests of greater than 95%. This solution was not obvious to the man skilled in the art in view of D1 either alone or in combination with the other documents cited in the International search report (Article 33(3) PCT).

Claims 24 and 31 are also novel and inventive.

Re Item VII

Certain defects in the international application

The subject-matter of claim 4 extends beyond the content of the application documents as originally filed, since page 7, lines 27/28 discloses merely organic sulphonic or carboxylic

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (SEPARATE SHEET)

International application No.

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acids, and not any organic acid as the present claim does (Article 34 PCT).







CLAIMS

- 1. Process for the production of thermoplastic vulcanizates, which comprises preparing a mixture of polymeric materials, including a matrix and a disperse phase component, and carrying out dynamic vulcanization of the disperse phase component, said dynamic vulcanization comprising the steps of grafting an organic silane on said disperse phase component, whereby to produce grafted disperse phase component chains, and crosslinking said disperse phase component chains in the presence of a crosslinking agent comprising an acid, said grafting and said cross-linking being carried out in the molten state of said disperse phase component.
- 2. Process according to claim 1, wherein the organic silane is an alkoxy silane.
- 3. Process according to claim 1, wherein said cross-linking agent is selected from the group consisting of inorganic acid, organic acid, anhydride of inorganic or organic acid, and polyfunctional compound having acid functionality in combination with an amine compound.
- 4. Process according to claim 3, wherein said cross-linking agent is selected from the group consisting of boric acid and adipic acid with an amine.
- 5. Process according to claim 4, wherein the amine of the combinations of adipic acid and an amine is triisopropanol amine or triethanol amine.
- 6. Process according to claim 1, wherein the dynamic vulcanization is carried out in batch mode.
- 7. Process according to claim 1, wherein the dynamic vulcanization is carried out in continuous mode.

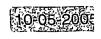
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temperature;

- c) allowing the grafting to take place;
- d) after the grafting, raising the temperature of the mixture to at least the melting point of the matrix, and the cross-linking agent and antioxidant;
- e) allowing the cross-linking to occur, whereby phase inversion occurs;
- f) optionally, devolatilizing the resulting product;
- g) adding any required additional components, while mixing; and
- h) discharging the final product.
- 23. Process according to claim 7, comprising the steps of:
 - a) feeding at least part of the matrix and all other polymeric components to the feed hopper of an extruder;
 - b) feeding silane and peroxide to a feeding zone of the extruder, while cooling said zone;
 - c) heating the grafting zone of the extruder to such a temperature as to melt the disperse phase component without melting the matrix;
 - d) kneading the resulting mixture;
 - e) feeding an additional feeder zone of the extruder the additives needed for causing cross-linking, including cross-linking agents and antioxidants;
 - f) if necessary, completing the feeding of the matrix;
 - g) mixing and kneading the mixture of the fed components, while heating;
 - h) removing the volatiles;
 - i) optionally adding extender oil and mixing; and
 - k) extruding the resulting product.
 - 24. Thermoplastic vulcanizates prepared in a process according to any one of claims 1 to 23, comprising a matrix and a cross-linked disperse phase, which are thermodynamically incompatible, said vulcanizates having the following properties:
 - a) low rigidity;

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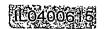




- b) high flexibility measured by low Shore hardness between 25A and 60D;
- c) disperse phase content of at least 50% by volume;
- d) high gel content of the vulcanized disperse phase component, preferably greater than 95%;
- e) high cross-link density of the vulcanized disperse phase component;
- f) white color;
- g) non-hygroscopicity;
- h) lack of toxic components; and
- i) narrow gaps (ligaments) between cross-linked disperse phase particles, providing near-continuity of said particles within the matrix.
- 25. Thermoplastic vulcanizates prepared in a process according to any one of claims 1 to 23, comprising a matrix and a cross-linked disperse phase, which are thermodynamically incompatible, said vulcanizates having the following properties:
 - a) low or medium rigidity;
 - b) disperse phase content of at least 50% by volume;
 - c) high gel content of the vulcanized disperse phase component, preferably greater than 95%;
 - d) high cross-link density of the vulcanized disperse phase component of more than 5*10-5 mol/cm³;
 - e) white color;
 - f) non-hygroscopicity;
 - g) lack of toxic components;
 - h) excellent processability by techniques used for processing thermoplastics, comprising extrusion, molding, thermoforming, blow molding, calendering;
 - i) very good impact resistance at room temperature and below 0°C; and
 - k) high melt elasticity and melt strength.
 - 26. Thermoplastic vulcanizates according to claims 24 and 25, wherein the matrix consists of semi-crystalline polymers or amorphous polymers.







- 27. Thermoplastic vulcanizates according to claims 24 and 25, wherein the semi-crystalline polymers are chosen in the group consisting of thermoplastic polyesters, polyacetals, polyvynilidene fluoride (PVDF), polycarbonate, polystyrene and styrene copolymers, crystalline polyethylene, ethylene copolymers, polypropylene homopolymer, propylene-ethylene random copolymer, heterophasic propylene-ethylene copolymer and polyamides.
- 28. Thermoplastic vulcanizates according to claims 24 and 25, wherein the content of matrix is 15 to 80 wt% of the total vulcanizate.
- 29. Thermoplastic vulcanizates according to claim 24 and 25, wherein the cross-linked disperse phase is chosen from the group consisting of polyethylene having density in the range 0.90 0.96 g/cm³, ethylene-alpha-olefin copolymers having density in the range 0.85 0.95 g/cm³, ethylene copolymers with vinyl acetate or acrylate or other polar monomers; chlorinated polyethylene, styrene block copolymers, natural rubber, polybutadiene, nitrile rubber, butadiene-styrene rubber, chloroprene rubbers, butyl rubber, hydrogenated rubbers, and blends thereof.
- 30. Thermoplastic vulcanizates according to claims 24 and 25, wherein the content of the disperse phase is 20 to 85 wt% of the total vulcanizate.
- 31. Products made from the thermoplastic vulcanizates of any one of claims 24 to 30, by known processing techniques, including extrusion, injection molding, thermiforming, blow molding and calendering.
- 32. Process according to claim 1, wherein said grafting and cross-linking do not require the addition of water into said mixture of polymeric materials.
- 33. Process according to claim 1, wherein said disperse phase component comprises more than 95% gel content.

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